INTEX-B Research

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Task 1—Mission Meteorologist

Prof. Fuelberg will be Mission Meteorologist during INTEX-B. He will be assisted by several graduate students. Their duties are listed below.

Weather Forecasting—The mission meteorologist prepares surface and flight level weather forecasts and provides briefings to the Science Team. Forecasting areas of clear skies will be especially important during INTEX-B since the DC-8's underpasses of the Aura satellite require virtually cloud free conditions.

Meteorological Products--Meteorological forecast products will be prepared for flight planning using gridded NWS numerical model output from the NWS Global Forecast System (GFS). These include streamline and tropopause height analyses, cross sections along flight tracks, and analyses of humidity and clouds.

Trajectories—We will prepare backward trajectories that arrive along the proposed INTEX-B flight tracks. We also will prepare forward trajectories from Mexico City and major population/industrial regions in Asia.

Forward Trajectories from Lightning--We will collect real time data from the National Lightning Detection Network (NLDN). Then, we will calculate forward trajectories from those lightning locations at various altitudes. Thus, the trajectories will provide guidance on where the DC-8 can intercept convectively influenced air.

Boundary Layer Exposure Product--We have developed a procedure to isolate air that previously was within the boundary layer—the source of most pollution. The procedure rigorously defines the boundary layer using established PBL criteria. During INTEX-B we will run the procedure in real time using data from the GFS model.

Prepare Post-Mission Meteorological Products--After INTEX-B is completed, we will prepare final meteorological products (e.g., trajectories, etc.) using only observed (not forecast) data. These products also will be based on the actual flight tracks.

Task 2—Integrate TES CO Data with Meteorology and with AIRS CO

TES will provide CO data at very high horizontal resolution. By using numerically-derived meteorological data at correspondingly fine resolution, we will seek to understand the processes that produce horizontal patterns in TES-derived CO and the temporal evolutions of those patterns. Similar research will be performed on nearly coincident AIRS-derived CO, with comparisons made between the two versions of CO. This in-depth understanding of the two versions of CO retrievals will provide important verification of Aura and Aqua CO products. Finally, research on the trans-Pacific transport of pollution will address one of the major science issues of INTEX-B—to quantify and characterize the inflow of pollution over North America. Detailed research plans are listed below.

- We will compare TES CO with that provided by AIRS during various meteorological scenarios and CO source situations. The AIRS retrievals during INTEX-B will be provided by Wallace McMillan at the University of Maryland, while the TES retrievals will be available from the NASA DAAC.

- We will focus on episodes of urban/regional pollution and biomass burning. There also may be cases of warm conveyor belts, areas of deep convection, or other types of meteorological transport processes.

- TES and AIRS provide somewhat different vertical resolutions of CO. We will examine how the vertical distribution of *in situ* and CTM-derived CO relates to that observed in synthetic imagery (described below) and from space-derived measurements.

- Model-derived meteorological parameters will be used to investigate the horizontal and vertical transport mechanisms that are occurring in each study case (e.g., warm conveyer belts, frontal lifting, deep convection, etc.). The transport mechanisms will be related to the AIRS and TES CO patterns.

- The model derived (STEM) meteorological data will be used to calculate the eastward transport (flux) of CO from Asia toward North America. These calculations will be made at several longitudes over the Pacific Ocean. The flux calculations will utilize STEM-derived CO, with separate calculations based satellite (AIRS)-derived CO. A comparison of the fluxes from each data source will help reveal the utility of using space derived data for these important types of calculations.

<u>Methodology</u>—Our methodology will be similar to that during INTEX-A.

- Four-dimensional simulated fields of CO for selected INTEX-B cases will be available from Greg Carmichael at the University of Iowa. Prof. Carmichael typically uses nested model domains in his STEM chemical transport model—approximating the different scales that are resolved by TES, AIRS, and suborbital platforms.

- The model-derived CO will be inserted into forward radiative transfer code to prepare synthetic AIRS radiances. These calculated spectra then will be used to prepare synthetic AIRS CO retrievals that are fully consistent with the meteorology driving STEM. Therefore, we can relate synthetic image features to the underlying meteorology.

- The meteorological data that are utilized in the STEM CTM will be available for the research involving the transport of pollution from Asia to North America.